

FORM PTO-1390 (Rev 5-93)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER ZAHFRI P400US
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. 10/031351
INTERNATIONAL APPLICATION NO. PCT/EP00/06779	INTERNATIONAL FILING DATE July 15, 2000	PRIORITY DATE CLAIMED July 22, 1999	

TITLE OF INVENTION

METHOD FOR TESTING THE FUNCTION OF AN ELECTROHYDRAULICALLY CONTROLLED AUTOMATIC TRANSMISSION

APPLICANT(S) FOR DO/EO/US

Markus HENNEKEN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
 2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
 3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
 4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
 5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau. (PCT/IB/308 mailed 01 February 2001).
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
 6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)) is attached.
 7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
 8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
 9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
 10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
- Items 11. to 16. below concern other document(s) or information included:
11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 with PTO FORM 1449.
 12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
 13. ☒ A FIRST preliminary amendment w/Marked-Up Version of Amended Specification.
 - ☐ A SECOND or SUBSEQUENT preliminary amendment.
 14. ☐ A substitute specification.
 15. ☐ A change of power of attorney and/or address letter.
 16. ☒ Other items or information:

<input checked="" type="checkbox"/> Preliminary Examination Report	<input checked="" type="checkbox"/> Copy of Request
<input checked="" type="checkbox"/> Annexes to Pre. Ex. Rep.	<input type="checkbox"/> Submission of Formal Drawing(s)
<input checked="" type="checkbox"/> International Search Report	<input type="checkbox"/> ___ sheets of formal drawing(s)
<input checked="" type="checkbox"/> German Novelty Search Report	<input checked="" type="checkbox"/> Abstract
<input checked="" type="checkbox"/> 11 copies of citations	<input checked="" type="checkbox"/> German Language Specification
<input checked="" type="checkbox"/> Form PCT/IB/308	<input type="checkbox"/>
<input checked="" type="checkbox"/> International Publ. No. WO 01/07802 A1 (Face page only)	

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date **January 17, 2002** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number **EL 918841561 US** addressed to the: Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Anthony G. M. Davis
(typed or printed name of person mailing paper)

Anthony G. M. Davis
(signature of person mailing paper)

PATENT & TRADEMARK OFFICE



020210

17. The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
 Search Report has been prepared by the EPO or JPO \$890.00
 International preliminary examination fee paid to USPTO (37 CFR 1.482) \$710.00
 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but
 international search fee paid to USPTO (37 CFR 1.445(a)(2)). \$740.00
 Neither international preliminary examination fee (37 CFR 1.482) nor
 international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1040.00
 International preliminary examination fee paid to USPTO (37 CFR 1.482)
 and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00
ENTER APPROPRIATE BASIC FEE AMOUNT =

CALCULATIONS PTO USE ONLY

JC13 Rec'd PCT/PTO 17 JAN 2002

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months
 from the earliest claimed priority date (37 CFR 1.492(e)).

Claims	Number Filed	Number Extra	Rate
Total Claims	7 - 20 =	0	x \$18.00
Independent Claims	1 - 3 =	0	x \$84.00
Multiple dependent claim(s) (if applicable)			+ \$280.00

TOTAL OF ABOVE CALCULATIONS =

Reduction by 1/2 for filing by small entity, if applicable. Applicant claims **Small Entity**
Status. (Note 37 CFR 1.9, 1.27, 1.28).

SUBTOTAL =

Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months
 from the earliest claimed priority date (37 CFR 1.492(f)).

TOTAL NATIONAL FEE =

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be
 accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

TOTAL FEES ENCLOSED =

Amount to be:
refunded \$

charged \$

a. ☒ A check in the amount of \$ 930.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 04-0213 in the amount of \$ to cover the above fees.
 A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to
 Deposit Account No. 04-0213. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or
 (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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PATENT & TRADEMARK OFFICE



020210

01/17/02

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Markus HENNEKEN
Serial no. :
For : METHOD FOR TESTING THE FUNCTION OF
AN ELECTROHYDRAULICALLY CONTROLLED
AUTOMATIC TRANSMISSION
Docket : ZAHFRI P400US

BOX PCT

The Commissioner of Patents and Trademarks
Washington, D.C. 20231

FIRST PRELIMINARY AMENDMENT

Dear Sir:

By way of preliminary amendment, please amend the above identified application as set forth below.

In the Specification:

Please cancel paragraphs 2, 4, 11 and 12 of the specification, in their entirety, in favor of a clean form of paragraphs 2, 4 and 12 of the specification, without any markings thereon, as follows. Accompanying this response is a copy of the original paragraphs of the specification which show the addition(s) (by underlining, shading and bold) and the deletion(s) (by strikeout) to the canceled specification paragraphs. Please enter the replacement specification paragraphs into the record of this case.

In the Claims:

Please cancel claims 1-7, without prejudice or disclaimer of the subject matter therein, in favor of new claims 8-14 as follows.

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[002] FIELD OF THE INVENTION

[004] BACKGROUND OF THE INVENTION

[012] SUMMARY OF THE INVENTION

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8. (NEW) A method for testing the function of an electrohydraulically controlled automatic transmission comprising the step of simulation of a vehicle operation wherein the input shaft of the transmission is connected with a driving source which produces preset rotational speeds and load ratios, the output shaft of the transmission being connected with a stationary torque-transmitting hub and the shifting elements existing in the transmission being tested when the output shaft is blocked with an input rotational speed which exactly suffices to supply, with hydraulic pressure, the pressure-setting elements for the shifting elements, a characteristic quantity being determined and indicated or stored.

9. (NEW) The method according to claim 8, comprising the step of using one of the setting element current at which the shifting element slips and at which the slip tends toward zero when the shifting element closes as the characteristic quantity.

10. (NEW) The method according to claim 8, comprising the step of using the hysteresis of the current threshold between opening and closing of the shifting element as the characteristic quantity.

11. (NEW) The method according to claim 8, comprising the step of using the slip rotational speed of the shifting element as the characteristic quantity.

12. (NEW) The method according to claim 8, comprising the step of using the torque transmitted to the torque hub as the characteristic quantity.

13. (NEW) The method according to claim 8, comprising the step of using the time needed to shift a shifting element with positive engagement as the characteristic quantity.

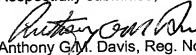
14. (NEW) The method according to claim 8, comprising the step of engaging the individual shifting elements are engaged successively, the shifting elements already tested remaining closed.

REMARKS

Accompanying this response, please find marked-up paragraphs of the specification which overcome some informalities noted in the specification. The undersigned avers that the enclosed replacement paragraph(s) of the specification do not contain any new matter.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,



Anthony G.M. Davis, Reg. No. 27,868

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10031351-011702

[001] METHOD FOR TESTING THE FUNCTION OF AN ELECTRO-
HYDRAULICALLY CONTROLLED AUTOMATIC TRANSMISSION

[002] FIELD OF THE INVENTION

[003] This invention relates to a method for testing on a testing stand the function of an electrohydraulically controlled automatic transmission by simulation of a driving operation, the input shaft of the transmission being connected with a driving machine which produces preset rotational speeds and load ratios.

[004] BACKGROUND OF THE INVENTION

[005] In the production in series of electrohydraulic automatic transmissions, there occurs within one and the same series of dispersion through different components and parts. This can result in the driving comfort failing differently in two identical automatic transmissions.

[006] Therefore, it is customary in the production in series of such transmissions to test the function upon a testing stand which simulates a vehicle operation, specific rotational speeds and load ratios being simulated by means of driving and driven machines in order then to control a gear change. The gear change is tested in the cycle according to a preset specification with reference to measuring data of input and output rotational speeds and torque sensors. Said test requires the interconnection of the transmission under dry circuit prior to the test proper for ventilating the clutches and pipes so as to obtain a reproducible test run of the power shifts.

[007] To obtain the most uniform possible driving comfort in the different transmissions of a series, it has already been proposed in DE-C 34 36 190 to use in the electronic control of the transmission adaptive functions. This is done by means of a device for electronic control wherein the electrohydraulically actuatable friction elements in the transmission produce the change between the different reduction steps and an actual value that characterizes the shifting operation, specially the grinding time, shifting time, or the rotational speed gradient during the grinding time, is compared with a stored nominal value, a correction value being stored when a presettable divergence is exceeded. This correction value has for the subsequent shifting operations a correcting effect in the sense of the adaptive

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[011] ~~Departing from a method of the kind specifically mentioned above, this problem is solved with the features stated in claim 1; advantageous developments are described in the sub-claims:~~

[012] **SUMMARY OF THE INVENTION**

[013] It has been found that the advantage obtained with the inventive method is that a very great saving of time in the order of 80% can be achieved. There is further obtained the advantage that during the test of an automatic transmission with the inventive method, by eliminating the dynamic portions which were formerly required, the errors can be better detected whereby the quality of the driving comfort is further enhanced. By associating "adjusted current" with "transmitted torque" it is possible qualitatively to make very accurate statements about the quality of the shifting functions of the automatic transmission. Tolerances between the separate automatic transmissions of one and the same series can be compensated by a balance of tolerance with storing of the data in the electronic transmission control whereby the quality of the end product is still further improved.

[014] Therefore, the invention provides that the automatic transmission be tested upon a testing stand with a driving machine of less power and with a torque measuring hub instead of the driven machine. Accordingly, this test of the shifting elements existing in the transmission such as brakes and clutches is conducted while the output is stationary and at a low input rotational speed which is precisely sufficient to supply the pressure setting elements in the transmission with hydraulic pressure and ensure the operation thereof. According to the invention the shifting element to be tested is caused to slip via the pressure-setting element and then closed again. This procedure takes no more than two seconds and spares the separate ventilation of the hydraulic components prior to performing the test.

[015] The characteristic quantity for the correct function of the shifting element tested is here the setting element current at which the shifting element slips or the slip tends toward zero when it closes.

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[001] METHOD FOR TESTING THE FUNCTION OF AN ELECTRO-
 HYDRAULICALLY CONTROLLED AUTOMATIC TRANSMISSION

[002]

[003] This invention relates to a method for testing on a testing stand the function of an electrohydraulically controlled automatic transmission by simulation of a driving operation, the input shaft of the transmission being connected with a driving machine which produces preset rotational speeds and load ratios.

[004]

[005] In the production in series of electrohydraulic automatic transmissions, there occurs within one an the same series of dispersion through different components and parts. This can result in the driving comfort failing differently in two identical automatic transmissions.

[006]

Therefore, it is customary in the production in series of such transmissions to test the function upon a testing stand which simulates a vehicle operation, specific rotational speeds and load ratios being simulated by means of driving and driven machines in order then to control a gear change. The gear change is tested in the cycle according to a preset specification with reference to measuring data of input and output rotational speeds and torque sensors. Said test requires the interconnection fo the transmission under dry circuit prior to the test proper for ventilating the clutches and pipes so as to obtain a reproducible test run of the power shifts.

[007]

To obtain the most uniform possible driving comfort in the different transmissions of a series, it has already been proposed in DE-C 34 36 190 to use in the electronic control of the transmission adaptive functions. This is done by means of a device for electronic control wherein the electrohydraulically actuable friction elements in the transmission produce the change between the different reduction steps and an actual value that characterizes the shifting operation, specially the grinding time, shifting time, or the rotational speed gradient during the grinding time, is compared with a stored nominal value, a correction value being stored when a presettable divergence is exceeded. This correction value has fo the subsequent shifting operations a correcting effect in the sense of the adaptive

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control upon the formation of a control valve for the friction elements, specially the hydraulic pressure. This device is specially adequate for automatic transmissions which as consequence of a defect have to be changed in a service workshop, a since otherwise the adaptive data stored in the electronic transmission control no longer coincide with the actual mechanical part fo the automatic transmission.

[008] A method for determining characteristic quantities of an electrohydraulically controlled automatic transmission on a testing stand with quick tying of the electronic control has been disclosed in the Applicant's WO 98/17929. Here gear shifts are successively initiated upon a testing stand in the individual reduction steps of the automatic transmission. During the gearshifts a transmission input and a transmission output rotational speed, the same as a transmission in put and a transmission output torque and the timed curves thereof are measured. From said measured values are determined as characteristic quantities of the automatic transmission for the clutch to be engaged during the gear change, a filling time, a charge pressure, a reaction time, a frictional value of the disks and a pressure liquid charge. Said characteristic quantities are thereafter stored in a memory so that the electronic transmission control unit can correct, according to said characteristic quantities, the pressure level and the time of the rapid filling pressure of the charge pressure, the same as the pressure level of the shifting pressure.

[009] Hereby the whole tolerance chain can be tested so that control and transmission tolerances be entirely detected. This leads to greater tolerances of the parts and thus to a less costly production. Since the values that characterize the respective transmission are stored in a memory, there is obtained in the electronic transmission control unit, even in case of great divergences between actual and nominal values, a quicker coincidence of the actual and nominal values. But a dry interconnection of the automatic transmission prior to the actual test for ventilating the clutches and pipes is also required here.

[010] The problem on which this invention is based is to provide a method of the kind mentioned above in which, without separate ventilation of the hydraulic components and within a shorter time, the function fo the transmission can be tested from the production in series.

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[011] Departing from a method of the kind specifically mentioned above, this problem is solved with the features stated in claim 1; advantageous developments are described in the sub-claims.

[012]

[013] It has been found that the advantage obtained with the inventive method is that a very great saving of time in the order of 80% can be achieved. There is further obtained the advantage that during the test of an automatic transmission with the inventive method, by eliminating the dynamic portions which were formerly required, the errors can be better detected whereby the quality of the driving comfort is further enhanced. By associating "adjusted current" with "transmitted torque" it is possible qualitatively to make very accurate statements about the quality of the shifting functions of the automatic transmission. Tolerances between the separate automatic transmissions of one and the same series can be compensated by a balance of tolerance with storing of the data in the electronic transmission control whereby the quality of the end product is still further improved.

[014] Therefore, the invention provides that the automatic transmission be tested upon a testing stand with a driving machine of less power and with a torque measuring hub instead of the driven machine. Accordingly, this test of the shifting elements existing in the transmission such as brakes and clutches is conducted while the output is stationary and at a low input rotational speed which is precisely sufficient to supply the pressure setting elements in the transmission with hydraulic pressure and ensure the operation thereof. According to the invention the shifting element to be tested is caused to slip via the pressure-setting element and then closed again. This procedure takes no more than two seconds and spares the separate ventilation of the hydraulic components prior to performing the test.

[015] The characteristic quantity for the correct function of the shifting element tested is here the setting element current at which the shifting element slips or the slip tends toward zero when it closes.

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- [016] One other characteristic quantity is the hysteresis of the current thresholds between the opening and losing of the shifting element, or the slip rotational speed of the shifting element, or also the torque transmitted to the torque-measuring hub.
- [017] Another characteristic quantity is the filling time needed in order to shift with positive engagement a shifting element. The flow rate thus determined that is actually absorbed is a measure for the tolerance of the air play, for the pressure supply and for the detection of errors (porosities, throttle positions.....).
- [018] An essential advantage, specially for an error search and a localization of causes of error, consists in that in the course of the testing method the shifting elements to be tested can be successively engaged, that is, the already shifted shifting elements remain closed and the new shifting element to be tested is shifted with positive engagement.
- [019] It has been found, by way of example, that in the testing of a five-step automatic transmission a saving of time of 80% was found during the testing with the inventive method.

Claims

1. Method for testing the function of an electrohydraulically controlled automatic transmission upon a testing stand by simulation of a vehicle operation wherein the input shaft of the transmission is connected with a driving machine which produces preset rotational speeds and load ratios, characterized in that the output shaft of the transmission is connected with a stationary torque-transmitting hub and that shifting elements existing in the transmission are tested when the output shaft is blocked with an input rotational speed which exactly suffices to supply with hydraulic pressure the pressure-setting elements for the shifting elements, a characteristic quantity being determined and indicated or stored.

2. Method according to claim 1, characterized in that as characteristic quantity is used the setting element current at which the shifting element slips or at which the slip tends toward zero when the shifting element closes.

3. Method according to claim 1, characterized in that as characteristic quantity is used the hysteresis of the current threshold between opening and closing of the shifting element.

4. Method according to claim 1, characterized in that as characteristic quantity is used the slip rotational speed of the shifting element.

5. Method according to claim 1, characterized in that as characteristic quantity is used the torque transmitted to the torque hub.

6. Method according to claim 1, characterized in that as characteristic quantity is used the time needed to shift a shifting element with positive engagement.

7. Method according to at least one of the preceding claims, characterized in that the individual shifting elements are engaged successively, the shifting elements already tested remaining closed.

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COMBINED DECLARATION AND POWER OF ATTORNEY
(Original, Design, National Stage of PCT, Supplemental)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

- original
design
supplemental
X National Stage of PCT
divisional (see added page)
continuation (see added page)
continuation-in-part (see added page)

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe that the original, first and sole inventor (*if only one name is listed below*) an original, first and joint inventors (*if plural names are listed below*) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

METHOD FOR TESTING THE FUNCTION OF AN ELECTROHYDRAULICALLY CONTROLLED AUTOMATIC TRANSMISSION

SPECIFICATION IDENTIFICATION

The specification of which: (complete (a), (b) or (c))

- (a) is attached hereto.
(b) was filed on _____ as "Serial No. _____
0 / _____ or "Express Mail No. _____ (as Serial
No. not yet known) _____ and was amended on _____ (if
applicable).
(c) **X** was described and claimed in PCT International
Application No. PCT/EP00/06779 filed on
15 July 2000 (15.07.2000) and as amended under PCT
Article 19 on _____ (if any).

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name(s) and registration number(s))

(3) Anthony G. M. Davis Registration No. 27,868
Michael J. Bujold Registration No. 32,018
Scott A. Daniels Registration No. 42,462

Attached as part of this Declaration and Power of Attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

Send Correspondence to
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(603) 624-9229

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ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent Office all information which is known to be material to patentability of this application as defined in § 1.56 of Title 37 of the Code of Federal Regulations.

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

COUNTRY	APPLICATION NO.	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
Fed. Rep. of Germany	199 34 486.8	(22.07.99) 22 July 1999	<input checked="" type="checkbox"/> YES NO
			YES NO
			YES NO
			YES NO
			YES NO

ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signature(s)

Full name of sole ~~author~~ inventor Markus HENNEKEN

Inventor's signature [Signature]

Date 19.10.01

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